REMARKS

Rejections under 35 USC §103(a)

Claims 5 was rejected under 35 USC §103(a) as being obvious over Sugiura et al. (U.S. Patent No. 5,638,889).

The Examiner alleged as follows:

> Sugiura discloses that Al-Mg alloy or Mg-Al alloy is heated to solidus temperature (A) with high heat rate (about 3.7°C/sec), heated at relative [sic] slower heating rate to above solidus temperature/semi-molten (B), than kept at temperature (C) (see Figure 12 and col. 14, lines 37-55). Heating rate between temperatures A and B is slower than room temperature to temperature A in order to obtain uniform temperature/zero temperature gradient (col. 14, lines 42-47). The heating is applicable to iron alloy also (col. 15, lines 54-58).

The allegation is not based on the claim recitations. Claim 5 recites as follows:

> 5. A process for heating a thixocast Fe-based alloy material having a chilled structure into a semi-molten state in which solid and liquid phases coexist, the process comprising:
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> heating said Fe-based alloy material setting an average rate H_R of heating from a **normal temperature to a point A_1 in an Fe-C based equilibrium diagram to be in a range of $0.5^{\circ}C/sec \leq H_R \leq 6.0^{\circ}C$ /sec**, and setting a maximum temperature gradient T_G of the inside of the Fe-based alloy material per unit distance to be at $T_G \leq 7^{\circ}C/mm$.

Claim 5 does not recite heating the Fe based alloy to solidus temperature with high heat rate, and then heating at relatively slower heating rate to above solidus temperature/semi-molten temperature. It is also irrelevant to claim 5, that the heating rate between temperatures A and B

is slower than room temperature to temperature A in order to obtain uniform temperature/zero temperature gradient in Sugiura et al.

Claim 5 is directed to a process for heating of Fe-based alloy material. Fe-based alloy material made by a continuous casting process is desirable for thixocasting due to its stability and productivity of components and metallographic structure of the material. In the continuous casting process, however, because the cooling rate of the Fe-based alloy material is high, a chilled structure is produced in the material in some cases. When such Fe-based alloy material is heated, problems arise. When the temperature gradient of the inside of the material increases depending on heating conditions, cracks occur in the material, and the cracks make it difficult to heat the material to a target temperature by induction heating.

Claim 5 provides a heating process by which a thixocast Fe-based alloy material having a chilled structure can be heated into a semi-molten state without generation of cracks in the material.

Sugiura does not teach or suggest "heating said Fe-based alloy material setting an average rate H_R of heating from a normal temperature to a point A_1 in an Fe-C based equilibrium diagram to be in a range of $0.5^{\circ}C/sec \leq H_R \leq 6.0^{\circ}C$ /sec, and setting a maximum temperature gradient T_G of the inside of the Fe-based alloy material per unit distance to be at $T_G \leq 7^{\circ}C/mm$."

More specifically, the portions of Sugiura et al pointed out by the Examiner such as col. 14, lines 37-55 and col. 15, lines 54-58 which relate to Mg-Al alloys, have nothing to do with the claimed invention. Sugiura et al teach that heating is conducted at relatively high speed until the

temperature is raised from ordinary temperature to a temperature. A corresponding to the solidus, and then heating is done at relatively slow speed until the temperature reaches a temperature B in a region where solid and liquid phases coexist. Thus the teachings of Sugiura et al should be interpreted such that in a solid phase region, the temperature is raised abruptly and, in a region where liquid phase is generated, the temperature is raised slowly for promoting generation of homogeneous liquid phase.

On the other hand, according to the present invention as defined in claim 5, the heating rate up to the point Ai in an Fe-C based equilibrium diagram, which is within the solid phase, is set appropriately (0.5°C/sec HR s 6.0°C/sec) and the temperature gradient of the inside of the Fe-based alloy material per unit distance up to the point A-1 is set to be not more than a specified value (TG s 7°C/mm), thereby preventing generation of cracks in the thixocast Fe-based alloy material. Thus, the present invention should be interpreted as relating to the art of adjusting the heating rate in the solid phase region. This is in contrast with the art of Sugiura et al which deals with adjusting the heating rate in a region where solid and liquid phases coexist.

The above discussion on the present invention is supported by the disclosure of Fig. 17 of the application showing Fe-C alloy, for example, that the solidus in Fig. 17 is at 150°C whereas the point Ai is at 740°C. The claimed invention relating to the point A, in an Fe-C based equilibrium diagram apparently deals with the heating in the solid phase region.

Sugiura et al describe in a very abstract manner at col. 4, lines 26-30 on the heating up to the solidus that an alloy is heated relatively quickly with high energy efficiency. The unique idea

of the present invention of adjusting the heating rate and temperature gradient in the solid phase region for preventing generation of cracks has not been taught or suggested at all.

If an Fe-C alloy is employed and heated in accordance with the teachings of Sugiura et al, it should be heated relatively quickly with high energy efficiency until the temperature reaches the solidus so that the clients believe cracks should be generated in a resulting material.

For at least these reasons, claim 5 patentably distinguishes over Sugiura et al.

Claims 6 was rejected under 35 USC §103(a) as being obvious over Sugiura et al. (U.S. Patent No. 5,638,889), and further in view of acknowledged prior art admission.

Claim 6 depends from claim 5. Therefore, claim 6 patentably distinguishes over Sugiura et al at for least the same reasons discussed above on claim 5. The acknowledged prior art admission referred by the Examiner does not remedy the deficiencies of Sugiura et al.

For at least these reasons, claim 6 patentably distinguishes over Sugiura et al and the acknowledged prior art admission.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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